Quiz 2/test prep 1
(front and back)

Name: _____
(please print neatly!)

Directions: Answer each of the following questions. Make sure to read the instructions for each question as you proceed. *For multiple choice questions, indicate your choice(s) by circling/drawing a box around the appropriate selection(s).*

Throughout, consider the transformation $T : \mathbb{R}^3 \to \mathbb{R}^4$ defined by $T : \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} \longmapsto \begin{pmatrix} -x_2 \\ 0 \\ x_1 \\ x_1 + x_3 \end{pmatrix}$.

1. **True or False:** T is a linear transformation. Justify your claim.

2. Compute:

$$T\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} = \_\_\_\_\_$$

$$T\begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = \_\_\_\_\_$$

$$T\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} = \_\_\_\_\_$$

3. Find the canonical matrix A corresponding to the transformation T such that $T(\mathbf{x}) = \mathsf{A}\mathbf{x}$ for all $\mathbf{x}$ or state that no such matrix exists.

4. What is the domain of T?

5. What is the codomain of T?

6. Find/describe the range of T.

   Hint: You can look at the right-hand side of T and write a *parametric vector form* for T; this will suffice!

7. Is the codomain of T equal to the range of T? How do you know? If they *aren't* the same, find a point in codomain(T) that *isn't* in range(T).

8. Is T injective/one-to-one? Justify your claim.

9. Is T surjective/onto? Justify your claim.

Scratch Paper